Claims

1. A process for hydroprocessing a heavy hydrocarbon feed using at least two reactors in which a heavy hydrocarbon feed is subjected sequentially to the steps of
   - hydroprocessing in a first hydroprocessing reactor, in which it is subjected sequentially to a hydrodemetallisation step, a hydrodesulfurisation step carried out at a temperature higher than that of said hydrodemetallisation step, and an asphaltene removal step carried out at a temperature higher than that of said hydrodesulfurisation step,
   - hydroprocessing in a second hydroprocessing reactor, in which it is subjected sequentially to a hydrodesulfurisation step and an asphaltene removal step, which latter is carried out at a temperature higher than that of said hydrodesulfurisation step.

2. The process of claim 1 wherein the hydrodemetallisation step is carried out using a hydrodemetallisation catalyst, the hydrodesulfurisation step is carried out using a hydrodesulfurisation catalyst, and asphaltene removal is carried out using an asphaltene removal catalyst.

3. The process of claim 2 wherein the hydrodemetallisation catalyst comprises a Group VIB metal component on a porous oxide carrier, the catalyst having a surface area of 50-200m^2/g and an average pore diameter of 10-35 nm, wherein the hydrodesulfurisation catalyst comprises a Group VIB metal component and a Group VIII metal component on a porous oxide carrier, the catalyst having a surface area of 50-400 m^2/g and an average pore diameter of 5-20 nm, and wherein the asphaltene removal catalyst comprises a Group VIB metal component on a porous oxide carrier, the catalyst having a surface area of 50-200m^2/g and an average pore diameter of 10-35 nm.

4. The process of claim 2 or 3 wherein the hydrodesulfurisation catalyst has a Group VIB metal content which is at least 2 wt.% higher than the Group VIB metal content of the hydrodemetallisation catalyst and the Group VIB metal content of the asphaltene removal catalyst.

5. The process of any one of claims 2-4 wherein the hydrodesulfurisation catalyst has an average pore diameter which is at least 1 nm below the average pore diameter of the hydrodemetallisation catalyst and the average pore diameter of the asphaltene removal catalyst.

6. The process of any one of claims 1-5 wherein a third hydroprocessing reactor is applied downstream of the second hydroprocessing reactor, in which third hydroprocessing reactor at least part of the effluent of the second hydroprocessing reactor is subjected sequentially to a hydrodesulfurisation step and an asphaltene removal step, which latter is carried out at a temperature higher than that of said hydrodesulfurisation step.

7. The process of any one of claims 1-5 wherein a third hydroprocessing reactor is applied downstream of the second hydroprocessing reactor, in which third hydroprocessing reactor at least part of the effluent of the second hydroprocessing reactor is subjected to a hydrodesulfurisation step.

8. The process of any one of claims 1-5 wherein a further hydroprocessing reactor is applied between the first hydroprocessing reactor and the second hydroprocessing reactor, in which further hydroprocessing reactor at least part of the effluent of the first hydroprocessing reactor is subjected to a hydrodesulfurisation step, with at least part of the effluent

of the further hydroprocessing reactor being led to the second hydroprocessing reactor.

9. The process of any one of the preceding claims wherein the feed is a heavy hydrocarbon feed of which at least 50 wt.% boils above 538°C and which comprises at least 2 wt.% of sulfur and at least 5 wt.% of Conradson Carbon.

10. The process of any one of the preceding claims wherein in the first reactor the temperature in the hydrodesulfurisation zone is at least 2°C above the temperature in the preceding hydrodemetallisation zone, while in the first, second, and optional further reactors the temperature in the asphaltene removal zones is at least 2°C above the temperature in the respective preceding hydrodesulfurisation zones.